Lexicographic Preferences in Discrete Choice Experiments: Consequences on Individual-Specific Willingness to Pay Estimates

Danny Campbell, W. George Hutchinson
and Riccardo Scarpa

NOTA DI LAVORO 128.2006

OCTOBER 2006

SIEV – Sustainability Indicators and Environmental Valuation

Danny Campbell and W. George Hutchinson, *Gibson Institute of Land, Food and Environment, Queen's University Belfast*
Riccardo Scarpa, *Waikato Management School, University of Waikato, New Zealand*

Lexicographic Preferences in Discrete Choice Experiments: Consequences on Individual-Specific Willingness to Pay Estimates

Summary

In discrete choice experiments respondents are generally assumed to consider all of the attributes across each of the alternatives, and to choose their most preferred. However, results in this paper indicate that many respondents employ simplified lexicographic decision-making rules, whereby they have a ranking of the attributes, but their choice of an alternative is based solely on the level of their most important attribute(s). Not accounting for these simple decision-making heuristics introduces systemic errors and leads to biased point estimates, as they are a violation of the continuity axiom and a departure from the use of compensatory decision-making. In this paper the implications of lexicographic preferences are examined. In particular, using a mixed logit specification this paper investigates the sensitivity of individual-specific willingness to pay (WTP) estimates conditional on whether lexicographic decision-making rules are accounted for in the modelling of discrete choice responses. Empirical results are obtained from a discrete choice experiment that was carried out to address the value of a number of rural landscape attributes in Ireland.

Keywords: Continuity axiom, Discrete Choice Experiments, Lexicographic Preferences, Mixed logit, Individual-Specific Willingness to Pay

JEL Classification: C35, Q24, Q51

Address for correspondence:

Danny Campbell
Queen's University Belfast
Gibson Institute of Land, Food and Environment
David Keir Building
Stranmillis Road
Belfast BT95AG
N Ireland
E-mail: d.cambell@qub.ac.uk

Lexicographic preferences in discrete choice experiments: consequences on individual-specific willingness to pay estimates

Abstract

In discrete choice experiments respondents are generally assumed to consider all of the attributes across each of the alternatives, and to choose their most preferred. However, results in this paper indicate that many respondents employ simplified lexicographic decision-making rules, whereby they have a ranking of the attributes, but their choice of an alternative is based solely on the level of their most important attribute(s). Not accounting for these simple decision-making heuristics introduces systemic errors and leads to biased point estimates, as they are a violation of the continuity axiom and a departure from the use of compensatory decision-making. In this paper the implications of lexicographic preferences are examined. In particular, using a mixed logit specification this paper investigates the sensitivity of individual-specific willingness to pay (WTP) estimates conditional on whether lexicographic decision-making rules are accounted for in the modelling of discrete choice responses. Empirical results are obtained from a discrete choice experiment that was carried out to address the value of a number of rural landscape attributes in Ireland.

1.0 Introduction

Since their introduction by Louviere and Hensher (1982) and Louviere and Woodworth (1983) there has been a growing number of studies using the discrete choice experiment methodology. Discrete choice experiments are consistent with the Lancasterian microeconomic approach (Lancaster, 1966), whereby individuals derive utility from the different characteristics, or attributes, that a good possesses, rather than directly from the good *per se*. Accordingly, a change in one of the attributes can cause a discrete switch from one alternative to another that will provide a superior combination of attributes. In discrete choice experiments, respondents are asked to choose their preferred alternative among several hypothetical alternatives in a choice set, and are typically asked to perform a sequence of such choices (Alpízar *et al.*, 2001). Experimental design theory is used to construct the alternatives, which are defined in terms of their attributes and the levels these attributes would take (Louviere, 2001).

A central principle of the discrete choice experiment methodology is the continuity axiom which implies respondents make trade-offs between the attributes across each of the alternatives, and choose their most preferred. Thus the continuity axiom rules out lexicographic orderings whereby respondents have a tendency to rank alternatives solely with reference to a sub-set of attributes, ignoring all other differences between the alternatives. However, evidence from a number of studies (see, for example, Rosenberger *et al*., 2003; DeShazo and Fermo, 2002; Sælensminde, 2001) suggests that many respondents violate the continuity axiom and hold non-compensatory preference structures such as lexicographic preferences for attributes within the choice set. Lexicographic choices occur when the respondent always chooses the alternative that is best, or worse, with respect to a specific attribute, or subset of alternatives. This may be due to an information processing strategy whereby respondents ignore attributes as a coping strategy in order to deal with the perceived complexity of the discrete choice experiment or because the attribute is truly not relevant in influencing the respondent's choice (Hensher *et al*., 2005b).

Lexicographic preferences are non-compensatory and, therefore, discontinuous which poses a problem for neoclassical analysis. Without continuity, there is no trade-off between two different attributes (McIntosh and Ryan, 2002; Rosenberger *et al*., 2003). Without a trade-off, there is no relative price and thus no tangency with the production frontier (Gowdy and Mayumi, 2001). Since lexicographic decision-making rules are a violation of the continuity axiom and a departure from the use of compensatory decision-making, discrete choice experiment studies should incorporate procedures to account for such heuristics (Sælensminde, 2002). Furthermore given that accounting for such preferences has been shown to influence welfare estimates (see, for example, Hensher *et al*., 2005b; Sælensminde, 2001; Rizzi and Ortúzar, 2003) research is warranted. Reported in this paper are the results from an empirical study that investigated the implications of a violation of the continuity axiom on welfare estimates. In particular, a mixed logit specification is used to highlight the sensitivity of individual-specific willingness to (WTP) estimates conditional on whether lexicographic decision-making rules are accounted for in the modelling of the discrete choice responses. Results from the analysis provide further evidence that modelling discrete choice without accounting for lexicographic preferences leads to biased WTP estimates.

The remainder of this paper is organised as follows. Section 2.0 provides a background on lexicographic decision-making rules, while Section 3.0 outlines the design of the empirical application, including the attributes, experimental design and tests for lexicographic

preferences. Section 4.0 details the mixed logit specification and reports the relevant results. Finally Section 5.0 draws conclusions and provides a number of recommendations.

2.0 Lexicographic decision-making rules

A basic assumption within the discrete choice experiment framework is that of unlimited substitutability between the attributes within the choice set. However, there is growing evidence that many respondents use non-compensatory decision-making rules when reaching their decisions in choice experiments. That is, some respondents have a ranking of the attributes, but their choice of an alternative is based solely on the level of their most important attribute(s). Respondents who have a hierarchy of values may express their preferences lexicographically (Rosenberger *et al.*, 2003). Lexicographic preferences are defined as a tendency for respondents to rank alternatives solely with reference to a sub-set of attributes, ignoring all other differences between the alternatives (Foster and Mourato, 2002).

Lexicographic preferences constitute a violation of the continuity axiom in the neoclassical framework. Such preferences can be classified according to either 'strict' lexicographic procedures where attributes are hierarchically ordered from the most important to the least important one and the preference is determined only by the most important attribute or 'modified' lexicographic preferences where choice is based on thresholds and minimum levels of an attribute are necessary (Lockwood, 1996). For a comprehensive survey on the literature of non-compensatory preferences see Spash (2000) and Rekola (2003).

While the incidence of lexicographic preferences is likely to be an indication that attributes within the choice set are not behaviourally relevant, that is, where respondents have indifferent preferences associated with those attributes not considered, there are many factors which can give rise to respondents employing lexicographic decision-making rules in discrete choice experiments. Internal factors, such as the complexity of the experiment (DeShazo and Fermo, 2002; Heiner, 1983; Swait and Adamowicz, 2001) or a consequence of the attributes within the experiment (Blamey *et al.*, 2001), are possible explanations for respondents employing such simplifying heuristics. External factors, such as the cognitive ability of the respondent, the strength of attitudes, beliefs, or dispositions that the respondent holds and other demographic characteristics of the respondent, are also likely to influence the use of lexicographic decision-making rules (Rosenberger *et al.*, 2003).

Discrete choice experiments impose a significant cognitive burden on respondents, which can compromise choice consistency (Sælensminde, 2001). Typically task complexity and cognitive burden facing respondents in a discrete choice experiment depends *inter alia* on the number of alternatives in each choice set, the number of attributes to describe the alternatives, the correlation structure of the attributes among alternatives, and the number of repetitions (Bennett and Blamey, 2001; Caussade *et al*., 2005). In complex situations respondents adopt simplified decision rules (DeShazo and Fermo, 2002). Moreover, increasing choice complexity widens the gap between a respondent's cognitive ability and the cognitive demands of the decision and thus leads to a restriction of the range of factors considered (Heiner, 1983). Respondents shift towards more lexicographic strategies in situations where there is correlation among the attributes or where they consider an attribute is of relatively high importance (Luce *et al*., 2000; Blamey *et al*., 2002). As a form of protest vote, respondents may also focus on a specific attribute for which they have a strong negative preference, whereby they place an absolute value on the attribute and refuse to make tradeoffs between it and another attribute (Spash and Hanley, 1995).

3.0 Empirical application

3.1 Defining the attributes

Reported in this paper are the results from a discrete choice experiment that was carried out to address the value of a number of rural landscape attributes in Ireland. The landscape attributes in question are the improvement of Wildlife Habitats, Rivers And Lakes, Hedgerows and Pastures. Three levels were used to portray these attributes according to varying levels of landscape improvement. To minimise respondent confusion the levels for each of the landscape attributes were denoted using the same labels: A Lot Of Action, Some Action and No Action. While the A Lot Of Action and Some Action levels represented a high level and an intermediate level of landscape improvement respectively, the No Action level represented the unimproved or status-quo condition. Image manipulation software was used to prepare photo-realistic simulations representing the landscape attributes under different management practices and levels of agricultural intensity. This involved the manipulation of a 'control' photograph to depict either more of or less of the attribute in question. This method was used so that on the one hand the changes in the attribute levels could be easily identified while holding other features of the landscape constant. On the other hand the respondent would not perceive as ostensibly unrealistic the computer generated landscape

illustrations. For the Wildlife Habitats attribute, a farmland landscape was depicted with different degrees of biodiversity. A range of eutrophication levels in a lake were used to represent the Rivers And Lakes attribute. The Hedgerows attribute was shown under different management practices. The effect on the landscape of different stocking densities was used to depict the Pastures attribute. All images and accompanying wording were tested in the focus group discussions and pilot study to ensure a satisfactory understanding and scenario acceptance by respondents.

The cost attribute was described as the expected annual cost of implementing the alternatives represented in the choice questions. This attribute was specified as the value that the respondent would personally have to pay per year, through their Income Tax and Value Added Tax contributions, to implement the alternative. Employing a sequential experimental design strategy enabled the levels of the monetary attribute to be adjusted in response to the preliminary findings following each phase of the survey. Altogether, seven price levels, ranging between €15 and €80 per year, were used to represent the cost attribute. As shown in Table 1, five tax levels were used in the first phase of the survey, two in the second and four in the final phase.

Table 1: Expected Annual Cost attribute price levels used during each phase of the survey

	€15	€20	€35	€40	€50	€65	€80
Phase 1		✓	✓		✓	✓	✓
Phase 2		✓					✓
Phase 3	✓	✓		✓	✓		

3.2 Experimental design

Since different experimental designs can significantly influence the accuracy of WTP estimates (Lusk and Norwood, 2005), it is important to use an experimental design that minimises an efficiency criterion. Given the national scope of this study, and the cost of surveys of this kind, sample size was also an issue. To increase sampling efficiency a sequential experimental design with a Bayesian information structure was employed (Sándor and Wedel, 2001).

A review of recent studies on experimental design (see, for example, Ferrini and Scarpa, 2005) reveals that the values in the matrix of attribute levels should be chosen so as to minimize some expected measure of variance, such as the D_p-optimality criterion:

$$D_p\text{-criterion} = \det\left\{I(\beta)^{-1}\right\}^{1/p}, \tag{1}$$

where $I(\cdot)$ is the information matrix of the multinomial logit model and p is the number of attributes. A more informative Bayesian measure, the D_b-optimal criterion, suggested in Sándor and Wedel (2001), which is the expected value of the D_p-criterion with respect to its assumed distribution over β or $\pi(\beta)$, was adopted with the arrangement of values in the matrix of attribute levels such that:

$$D_b\text{-criterion} = E_\beta\left[\left\{\det I(\beta)^{-1}\right\}^{1/p}\right] = \int_{\mathbb{R}^p}\left\{\det I(\beta)^{-1}\right\}^{1/p}\pi(\beta)\ d\beta. \tag{2}$$

As a prior an informative multivariate normal distribution centred on β was used with a variance-covariance matrix, both of which were derived initially from the first phase of the survey, and subsequently updated at each phase by the pooled dataset from previous phases of sampling. This is achieved in practice by simulating the value of this criterion by drawing from the assumed distribution of βs, computing the value of the criterion for each draw, and then averaging it out. The best allocation of values is found by using heuristic algorithms, such as *swapping* and *relabelling* (Huber and Zwerina, 1996) and *cycling* (Sándor and Wedel, 2001):

$$\tilde{D}_b = \frac{1}{R}\sum_{r=1}^{R}\left\{\det I(\beta)^{-1}\right\}^{1/p}, \tag{3}$$

where R is the number of draws.

Starting from a conventional main effects fractional factorial in the first phase, a Bayesian design was employed in the second wave of sampling. The design for the final phase incorporated information from the first and second phases. However, not all values of the attributes were allocated in the design by the above approach. The numerical values of cost were assigned on the basis of realism and so as to balance the probabilities of choices across alternatives in the choice set (Kanninen, 2002). For further information and an evaluation of the efficiency of the sequential experimental design approach used in this study see Scarpa *et al*. (2005).

Each choice set consisted of two experimentally designed alternatives, labelled Option A and Option B, and a status-quo alternative, labelled No Action, which portrayed all the landscape attributes at the No Action level with zero cost to the respondent. An example choice set is shown in Figure 1.

3.3 Determining lexicographic decision-making rules

In total, the choice experiment was administered by experienced interviewers to a representative sample of 600 respondents drawn from the Irish adult population in 2003/4. With a further 166 potential respondents refusing to complete the interview, the overall response rate was 78 percent. During the choice experiment each respondent was asked to indicate their preferred alternative in a panel of repeated choice sets. Following the discrete choice experiment, respondents who did not always choose the No Action alternative were asked to identify the attribute, or attributes, they considered in making their choices. Although this did not provide the precise weight respondents attached to the attributes, it identified the attributes that they ignored.

In total 36 respondents always choose the No Action alternative. The attributes or combinations of attributes considered by the remaining 564 respondents during the discrete choice experiment are reported in Table 2. Table 2 shows that 61 (11 percent) respondents focused solely on the Rivers And Lakes attribute. Collectively 48 (9 percent) respondents focused solely on one of the remaining attributes. Hence around one-fifth of respondents considered only one attribute in the discrete choice experiment, thus providing no information on their willingness to make trade-offs among the attributes. When reaching their decisions in the choice experiment 60 (11 percent) respondents took into account two attributes. Three and four attributes were considered by 27 (5 percent) and seven (1 percent) respondents respectively. All of the attributes were considered in the choice experiment by 361 (64 percent) respondents. Further investigation of Table 2 reveals that the Rivers And Lakes attribute was considered by 500 (89 percent) respondents. This high proportion may be due to the fact that the Rivers And Lakes attribute was perceived as a 'causal' attribute (Blamey *et al*., 2002) in which it was considered to an important indicator of the overall state of the rural environment. It was also likely to be associated with the quality of drinking water. Furthermore, respondents who participate in water-based recreational activities are likely to attach higher attention to the Rivers And Lakes attribute. The Wildlife Habitats, Pastures and Hedgerows attributes were taken into account in the choice experiment by 437 (77 percent), 416 (74 percent) and 399 (71 percent) respondents respectively. The Cost attribute was considered by 391 (69 percent). Thus the Cost attribute was the attribute least taken into account in the choice experiment which is an important finding in a study that is primarily concerned with deriving WTP estimates. This result would suggest that many respondents wanted rural landscape improvements irrespective of the costs involved.

	Option A	Option B	No Action
Wildlife Habitats	 Some Action	 A Lot Of Action	 No Action
Rivers And Lakes	 No Action	 Some Action	 No Action
Hedgerows	 Some Action	 A Lot Of Action	 No Action
Pastures	 A Lot Of Action	 No Action	 No Action
Expected Annual Cost	€ 20	€ 80	€ 0
Which do you prefer?	☐	☐	☐

Figure 1: Example choice set

While the incidence of lexicographic preferences may have been a result of the complexity of the experiment or a consequence of the levels of the attributes within the experiment (Heiner, 1983; Ryan and Bate, 2001), the development of the discrete choice experiment exercise reported here involved several rounds of design and testing. This process began with a qualitative review of expert opinions to establish the range over which the landscape attribute vary. Further qualitative research was then carried out to refine the definitions of the

landscape attributes and define an appropriate payment vehicle and levels thereof. An important aim of the focus group discussions was also to identify the appropriate level of choice task complexity (that is, the number of alternatives and attributes). This was achieved through a series of focus group discussions with members of the public. Following the focus group discussion pilot testing of the survey instrument was conducted in the field. This allowed the collection of additional information, which along with expert judgement and observations from the focus group discussions, was used to design the discrete choice experiment used in the public survey. Therefore the incidence of attributes not taken into account during the choice experiment is most likely because they were truly not relevant in influencing the respondent's choice. Despite this, lexicographic preferences as a coping strategy in order to deal with the complexity experiment cannot be ruled out completely.

4.0 Mixed logit specification and results

Mixed logit models provide a flexible and computationally practical econometric method for any discrete choice model derived from random utility maximisation (McFadden and Train, 2000). The mixed logit model obviates the three limitations of standard logit by allowing for random taste variation, unrestricted substitution patterns, and correlation in unobserved factors (Train, 2003). Mixed logit does not exhibit the strong assumptions of independent and identically distributed error terms and its equivalent behavioural association with the independence of irrelevant alternatives property. Mixed logit panel estimation also affords a desirable avenue for highlighting the implications of lexicographic decision-making rules on WTP, where one can derive individual-specific estimates conditional on the observed individual choices x^n and y^n (Train, 2003; Hensher and Greene, 2003; Sillano and Ortúzar, 2005). This can be achieved by applying Bayes' theorem to derive the expected value of the ratio between the landscape attribute parameter estimate (*land*) and the parameter estimate for the Cost attribute (*cost*):

$$E\left[\text{WTP}^n\right] = E\left[-\frac{\beta_{land}^n}{\beta_{cost}^n}\right] = \int_{\beta^n} \beta^n P\left(\beta^n \mid y^n, x^n\right)\, d\beta^n. \tag{4}$$

It is well known that given two outcomes A and B, Bayes' theorem relates $P(B|A)$ to the conditional probability of $P(BA)$ and the two marginal probabilities $P(A)$ and $P(B)$ as follows:

$$P(B \mid A) = \frac{P(A \mid B)P(B)}{P(A)}. \tag{5}$$

Table 2: Attributes and combinations of attributes taken into account by the respondents during the discrete choice experiment

Attributes and combinations of attributes taken into account	**Number**	**Percent**
Wildlife Habitats	14	2.48
Rivers And Lakes	61	10.82
Hedgerows	2	0.35
Pastures	18	3.19
Cost	14	2.48
Wildlife Habitats and Rivers And Lakes	26	4.61
Wildlife Habitats and Hedgerows	2	0.35
Wildlife Habitats and Pastures	6	1.06
Wildlife Habitats and Cost	1	0.18
Rivers And Lakes and Hedgerows	5	0.89
Rivers And Lakes and Pastures	12	2.13
Rivers And Lakes and Cost	3	0.53
Hedgerows and Pastures	2	0.35
Pastures and Cost	3	0.53
Wildlife Habitats, Rivers And Lakes and Hedgerows	14	2.48
Wildlife Habitats, Rivers And Lakes and Pastures	3	0.53
Wildlife Habitats, Rivers And Lakes and Cost	3	0.53
Rivers And Lakes, Hedgerows and Pastures	2	0.35
Rivers And Lakes, Hedgerows and Cost	2	0.35
Rivers And Lakes, Pastures and Cost	1	0.18
Hedgerows, Pastures and Cost	2	0.35
Wildlife Habitats, Rivers And Lakes, Hedgerows and Pastures	6	1.06
Wildlife Habitats, Rivers And Lakes, Hedgerows and Cost	1	0.18
Wildlife Habitats, Rivers And Lakes, Hedgerows, Pastures and Cost	361	64.01
Total	**564**	**100.00**

So, substituting in

$$E\left[\,\mathrm{WTP}^n\,\right] = E\left[\,-\frac{\beta^n_{land}}{\beta^n_{\cos t}} \mid y^n, x^n\,\right] = \int_{\beta^n} \frac{\beta^n_{land}}{\beta^n_{\cos t}} \frac{P(y^n, x^n \mid \beta^n) P(\beta^n)}{P(y^n, x^n)}\; d\beta^n,$$

$$= \int_{\beta^n} \frac{\beta^n_{land}}{\beta^n_{cost}} \frac{P(y^n, x^n \mid \beta^n) P(\beta^n)}{\int_{\beta^n} P(y^n, x^n \mid \beta^n) P(\beta^n) \; d(\beta^n)} \; d\beta^n,$$

$$= \frac{\int_{\beta^n} \frac{\beta^n_{land}}{\beta^n_{cost}} P(y^n, x^n \mid \beta^n) P(\beta^n) \; d(\beta^n)}{\int_{\beta^n} P(y^n, x^n \mid \beta^n) P(\beta^n) \; d(\beta^n)}. \tag{6}$$

With knowledge of the β estimates this can be approximated by simulation as follows:

$$\hat{E}\left[\text{WTP}^n\right] = \frac{\frac{1}{R}\sum_R \frac{\hat{\beta}^n_{land}}{\hat{\beta}^n_{cost,r}} L\left(\hat{\beta}^n_r \mid y^n, x^n\right)}{\frac{1}{R}\sum_R L\left(\hat{\beta}^n_r \mid y^n, x^n\right)}. \tag{7}$$

where L is the logit probability. In this way the individual WTP estimates are obtained conditional on all the information from the choice experiment interview.

Computation of mixed logit choice probabilities using classical estimation procedures typically requires Monte Carlo integration. The basis of this computation is the generation of pseudo-random sequences that are intended to mimic independent draws from the underlying distribution of the random variable of integration. An alternative approach proposed by Bhat (2001) and Train (1999) replaces these pseudo-random sequences with sequences based on a deterministic Halton sequence. One-dimensional Halton sequences are created using any prime number $p(\geq 2)$. The unit interval [0,1] is divided into p equally-sized segments, and the endpoints or breaks of these segments form the first p numbers in the Halton sequence. Successive numbers in sequence are generated by further subdividing each segment into p equally-sized segments and adding the breaks in a particular order. The resulting Halton draws thus achieve greater precision and coverage for a given number of draws than pseudo-random draws, since successive Halton draws are negatively correlated and therefore tend to be self-correcting (Train, 2003). Accordingly many fewer draws are needed to assure reasonably low simulation error in the estimated parameters. In fact both Bhat (2001) and Train (1999) demonstrate that for a mixed logit model, 100 Halton draws provides results that were more accurate than 1,000 pseudo-random draws. Overall the application of Halton draws allows a decrease in computation time without sacrificing precision. However while multi-dimensional Halton sequences generally provide better coverage than the corresponding pseudo-random number sequences, problems with high correlation can occur between

sequences constructed from higher primes, and thus sequences used in higher dimensions. To ameliorate this, modified procedures such as scrambled and shuffled Halton draws have been used (see, for example, Bhat, 2003; Hess and Polak, 2003). Both these sequences have been found to outperform the standard Halton sequence. As a result shuffled Halton sequences, with 100 draws, are used in this paper to estimate the mixed logit models.

A key element of the mixed logit model is the assumption regarding the distribution of each of the random parameters. Random parameters can take a number of predefined functional forms, the most popular being normal, lognormal, uniform and triangular (Hensher, *et al*., 2005a). In most applications, such as Layton and Brown (2000), Revelt and Train (1998), and Train (1998), the random parameters are specified as normal or lognormal. Greene *et al*. (2005), and Greene *et al*. (2006) have used uniform and triangular distributions. However it is well known that choices of some commonly employed mixing distribution implies behaviourally inconsistent WTP values, due to the range of taste values over which the distribution spans. Normal and log-normal distributions are particularly problematic (Train and Weeks, 2005). This is due to the presence of a share of respondents with the 'wrong' sign in the former, and the presence of fat tails in the latter. This is of particular importance in a study concerned with improvements from the status-quo, on which taste intensities are expected to be positive.[1] Following Hensher *et al*. (2005b), a bounded triangular distribution is used in this paper in which the location parameter is constrained to be equal to its scale. Such a constraint forces the distribution to be bounded over a given orthant, the sign of which is the same as the sign of the location parameter. In practice, for all random parameters associated with the various categories of rural landscape improvements it is assumed that $\beta \sim \tau(\theta)$, where θ is both the location and scale parameter of the triangular distribution $\tau(\cdot)$.[2] This included cost, which was bounded to the negative orthant.

When the status-quo option is included in the set of alternatives, such inclusion can cause respondents to regard the status-quo alternative in a systematically different manner from the designed alternatives involving changes from the status-quo. This is because the status-quo is actually experienced, while the experimentally designed options are hypothetical. As a result, the utility from experimentally designed hypothetical alternatives are more correlated amongst themselves than with the utility associated with the status-quo. This may be

[1] For a general discussion on bounding the range of variation in random utility models see Train and Sonnier (2005) who propose a Bayesian estimation approach, for an application of bounding directly to the expenditure function see Train and Weeks (2005).
[2] See Hensher *et al*. (2005a) for a description of the triangular distribution in this context.

captured by a specification with additional errors accounting for this difference in correlation across utilities. Correlation is a consequence of the fact that experimental alternatives share this extra error component, which instead is absent from the status-quo alternative. Previous studies have found theoretical reasons for status-quo bias (Samuelson and Zeckhauser, 1988; Haaijer *et al*., 2001), and choice experiment applications in environmental economics (see, for example, Lehtonen *et al*., 2003; Kontoleon and Yabe, 2003) found these effects to be significant. Status-quo effects are examined by including an alternative specific constant representing the No Action alternative is included in the mixed logit model specification. A positive sign would indicate that *ceteris paribus* the status-quo alternative is more desirable. A negative sign would mean it is less so.

Reported in Table 3 are the parameter estimates for two models. Model 1 pertains to the estimation of the discrete choice experiment without accounting for lexicographic decision-making rules. The estimates of Model 2 were obtained after accounting for such heuristics. Following Hensher *et al*. (2005b), to ensure unnecessary weight was not placed on attributes which were ignored, the mean and standard deviations estimates in Model 2 were specified as a function of a dummy variable representing whether or not the attribute was considered by the respondent. Parameter estimates in both models were generated using 100 shuffled Halton draws. In both models the random parameters were specified as random with constrained triangular distributions to ensure non-negative WTP for landscape improvements over the entire range of the distribution. The number of respondents and observations in both models was 564 and 4036 respectively. The log-likelihood function at convergence is -2686.782 for Model 1 and -2646.363 for Model 2, indicating a better model fit is achieved when lexicographic preferences are accounted for. Both models are found to be statistically significant with a χ^2 statistic of 3494.435 and 3575.272 for Model 1 and Model 2 respectively against a χ^2 critical value of 18.307 (with 10 degrees of freedom at alpha equal to 0.05).

Across both models estimated coefficients are all found to be statistically significant and of the expected sign. The relative dimensions of the parameter estimates for the landscape attributes conformed with theoretical expectations of decreasing marginal utility. While the level of significance of the parameter estimates for the landscape attributes did not vary substantially, the Cost attribute was estimated with a much higher level of significance which enabled WTP to be estimated more precisely. The status-quo alternative specific constant was found to be negative and significant in both models indicating that the respondents found the No Action is less desirable than the experimentally designed alternatives.

Table 3: Comparison of a model that assumes no lexicographic preferences with a model that accounts for lexicographic preferences

	Model 1 Assuming no lexicographic preferences				**Model 2** Accounting for lexicographic preferences			
	Mean		Scale		Mean		Scale	
	Beta	*t*-ratio	Beta	*t*-ratio	Beta	*t*-ratio	Beta	*t*-ratio
WH_ALot	0.774	10.966	0.774	10.966	0.743	9.951	0.743	9.951
WH_Some	0.572	7.200	0.572	7.200	0.429	5.384	0.429	5.384
RL_ALot	1.786	20.334	1.786	20.334	1.874	21.116	1.874	21.116
RL_Some	1.069	13.067	1.069	13.067	0.987	13.091	0.987	13.091
H_ALot	0.494	7.027	0.494	7.027	0.497	6.370	0.497	6.370
H_Some	0.262	3.765	0.262	3.765	0.181	2.383	0.181	2.383
P_ALot	0.736	10.380	0.736	10.380	0.743	9.833	0.743	9.833
P_Some	0.706	9.023	0.706	9.023	0.685	8.465	0.685	8.465
Cost	-0.004	-4.008	0.004	4.008	-0.009	-7.235	0.009	7.235
SQ ASC	-0.864	-4.555	Non-random		-1.646	-12.155	Non-random	
Log-likelihood	-2686.782				-2646.363			
χ^2	3494.435				3575.272			
Pseudo-R^2	0.394				0.403			
BIC	5467.579				5386.743			

To highlight the effect of various forms of violations of the continuity axiom, median and mean individual-specific WTP estimates obtained from Model 1 and 2 in Table 3 are compared in Table 4. The estimates based on the analysis that did not account for lexicographic preferences are quite high, and their aggregate total exceeds what we expect an individual Irish citizen would be WTP for landscape improvements. This finding is probably due to fact that a large proportion of respondents ignored the Cost attribute and thus did not trade-off the landscape improvements with cost of improvement. Lexicographic preferences are not necessarily an indication of strong preferences for a subset of attributes. Indeed respondents may focus on a subset of attributes as a form of protest voting behaviour whereby they place an absolute value on the attribute and refuse to make tradeoffs between it and another attribute. The empirical results reported here, however, do not support this view. Higher WTP estimates were attached to those attributes which were concentrated on most in

Table 4: Comparison of the individual-specific WTP descriptive statistics derived from the model that assumes no lexicographic preferences with a model that accounts for lexicographic preferences

	Model 1 Assuming no lexicographic preferences (Euro/year)		**Model 2** Accounting for lexicographic preferences (Euro/year)		**Difference** Change between Model 1 and Model 2 (Percent)	
	Median	Mean	Median	Mean	Median	Mean
WH_ALot	243.55	258.99	100.73	91.82	-58.64	-64.55
WH_Some	175.88	186.46	59.01	51.63	-66.45	-72.31
RL_ALot	553.26	547.85	260.81	242.23	-52.86	-55.78
RL_Some	328.84	343.46	141.31	133.39	-57.03	-61.16
H_ALot	154.34	160.66	65.11	53.38	-57.82	-66.78
H_Some	80.71	85.06	23.86	19.86	-70.43	-76.65
P_ALot	234.29	251.44	101.18	89.58	-56.81	-64.37
P_Some	218.46	235.26	93.25	80.37	-57.31	-65.84

the choice experiment. In line with this finding, attaching unnecessary weight to the attributes led to an overestimation of the WTP estimates. Accounting for lexicographic preferences resulted in a lowering of the WTP and thus provided more plausible estimates. In fact accounting for lexicographic preferences resulted in a lowering of median and mean individual-specific WTP estimates by over 50 percent for all attributes. This result is robust to other ways of computing welfare measures (for example, using population moments). Notice also that while the implied monotonicity of the two levels of action is adequately reflected in the magnitude of individual-specific WTP estimates across both models in Table 4, the implied preference ordering varied across the models.

To highlight the features of the WTP distributions the box-plots for these distributions are reported in Figure 2. From the locations of the box-plots it is apparent that as one moves from the estimates obtained from assuming no lexicographic preference to those obtained when lexicographic preferences are taken into account the WTP distributions shift markedly to the left. Non-overlapping notches indicate rejection of the null of equal medians. A further finding illustrated by Figure 2, is that the spread and variability of WTP estimates for the Wildlife Habitats and Rivers And Lakes attributes is lower when lexicographic decision-making rules are accounted for. However this result was not found for the Hedgerows and

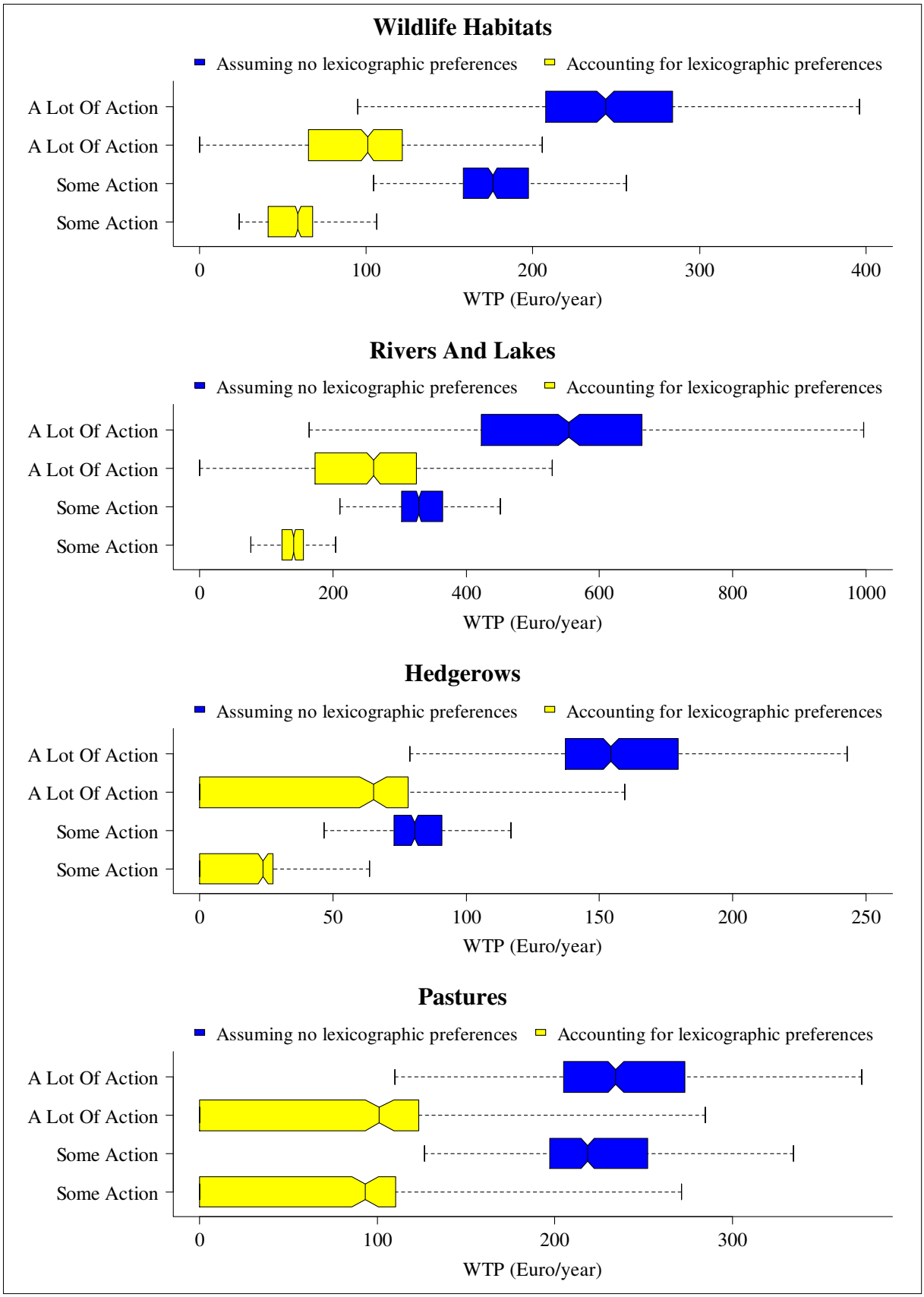

Figure 2: Box-Plots of distributions of individual-specific WTP estimates for the landscape attributes

Pastures attributes. This is because more than 25 percent of respondents ignored these attributes which meant their lower hinge was positioned at zero. Another robust result illustrated by Figure 2, is that the WTP distributions which accounted for lexicographic preferences are positively skewed to a greater extent, which is in keeping with prior expectations.

5.0 Conclusions and recommendations

A basic assumption within the discrete choice experiment framework is that of unlimited substitutability between the attributes within the choice set. Evidence reported in this paper revealed that many respondents use lexicographic decision-making rules when reaching their decisions in choice experiments. Lexicographic preferences constitute a violation of the continuity axiom in the neoclassical framework.

Reported in this paper are the results from an empirical study which investigated the implication on WTP of lexicographic decision-making rules. The analysis is conducted on the results from a discrete choice experiment that was conducted in Ireland designed to elicit WTP for a number of landscape attributes. The landscape attributes in question were Wildlife Habitats, Rivers And Lakes, Hedgerows and Pastures. Each of these landscape attributes were depicted with three levels, either A Lot Of Action, Some Action or No Action. Since valuation of landscape improvements can be very subjective, and verbal descriptions can be interpreted differently depending on individual experience, each level of improvement was qualified by means of digitally manipulated images of landscapes. This study also attempted to take stock of the main advances in the areas of multi-attribute stated preference techniques. In particular, a sequential experimental design with an informative Bayesian update, in addressing the heterogeneity of the estimation of the structural parameters of the random utility model the distributions of taste-parameters were bounded to account for the fact that landscape improvement takes the form of an improvement on the status-quo.

Several findings are reported. Almost one third of the respondents ignored the Cost attribute in reaching their decisions in the discrete choice experiment, which is an important finding in a study that was primarily concerned with the valuation of non-market goods. A further finding was that better model fit was achieved when lexicographic preferences were accounted for. In addition the Cost attribute was estimated with much higher precision. Lexicographic preferences were found to affect the weights assigned to each attributes in the analysis of discrete choice models, which in turn led to increased variability in the WTP

estimates. Moreover the distributions of individual WTP estimates conditional on observed choices were found to be sensitive to whether lexicographic decision-making rules were accounted for because markedly lower WTP estimates were obtained. In fact WTP estimates were less than half as high as those obtained when lexicographic decision-making were accounted for in the mixed logit model. This has clear implications when discrete choice experiments are used for policy appraisal and the valuation of non-market goods.

This paper explored the sensitivity of lexicographic preferences on individual-specific WTP estimates. Deciding whether or not to account for such preferences is a judgement that should not be based on statistical criteria alone. However lexicographic preferences do not satisfy the underlying continuity axiom and are a departure from the use of compensatory decision-making. The fact that a significant proportion of respondents employed these simple decision-making heuristics, combined with the reported effect that accounting for lexicographic preferences resulted in a substantial lowering of WTP estimates, suggests some caution when this issue is neglected in deriving non-market valuation estimates by means of the discrete choice experiment methodology. The evidence presented in this paper quite clearly suggests that choice experiment studies should incorporate procedures for identifying respondents who have lexicographic preferences and that the sensitivity of such preferences on WTP should be evaluated.

References

Alpízar F., Carlsson F. and Martinsson P. (2001). Using choice experiments for non-market valuation. *Economic Issues* **8**(1): 83-109.

Bennett J.W. and Blamey R. (2001). The strengths and weaknesses of environmental choice modelling. In J.W. Bennett and R. Blamey (Eds.), *The choice modelling approach to environmental valuation*. Edward Elgar: Cheltenham.

Bhat C.R. (2001). Quasi-random maximum simulated likelihood estimation of the mixed multinomial logit model. *Transportation Research Part B* **35**: 677-693.

Bhat C.R. (2003). Simulation estimation of mixed discrete choice models using randomized and scrambled Halton sequences. *Transportation Research Part B* **37**: 837-855.

Blamey R., Louviere J.J. and Bennett J.W. (2001). Choice set design. In J.W. Bennett and R. Blamey (Eds.), *The choice modelling approach to environmental valuation*. Edward Elgar: Cheltenham.

Blamey R.K., Bennett J.W., Louviere J.J., Morrison M.D. and Rolfe J.C. (2002). Attribute causality in environmental choice modelling. *Environmental and Resource Economics* **23**: 167-186.

Caussade S., Ortúzar J.D., Rizzi L.I. and Hensher D.A. (2005). Assessing the influence of design dimensions on stated choice experiment estimates. *Transportation Research Part B* **39**: 621-640.

DeShazo J.R. and Fermo G. (2002). Designing choice sets for stated preference methods: the effects of complexity on choice consistency. *Journal of Environmental Economics and Management* **44**: 123-143.

Ferrini S. and Scarpa R. (2005). Experimental designs for environmental valuation with choice experiments: a Monte Carlo investigation, *European Association of Environmental and Resource Economists Annual Conference*: Bremen.

Foster V. and Mourato S. (2002). Testing for consistency in contingent ranking experiments. *Journal of Environmental Economics and Management* **44**: 309-328.

Gowdy J.M. and Mayumi K. (2001). Reformulating the foundations of consumer choice theory and environmental valuation. *Ecological Economics* **39**: 223-237.

Greene W.H., Hensher D.A. and Rose J. (2005). Using classical simulation-based estimators to estimate individual WTP values. In R. Scarpa and A. Alberini (Eds.), *Applications of simulation methods in environmental and resource economics*. Springer: Dordrecht.

Greene W.H., Hensher D.A. and Rose J. (2006). Accounting for heterogeneity in the variance of unobserved effects in mixed logit models. *Transportation Research Part B* **40**: 75-92.

Haaijer R., Kamakura W. and Wedel M. (2001). The 'no-choice' alternative in conjoint choice experiments. *International Journal of Market Research* **43**(1): 93-106.

Heiner R.A. (1983) The origin of predictable behavior. *The American Economic Review* **73**(4): 560-595.

Hensher D.A. and Greene W.H. (2003). The mixed logit model: the state of practice. *Transportation* **30**: 133-176.

Hensher D.A., Rose J. and Greene W.H. (2005a). *Applied choice analysis: a primer*. Cambridge University Press: Cambridge.

Hensher D.A., Rose J. and Greene W.H. (2005b). The implications on willingness to pay of respondents ignoring specific attributes. *Transportation* **32**: 203-222.

Hess S. and Polak J. (2003). An alternative method to the scrambled Halton sequence for removing correlation between standard Halton sequences in high dimensions, *European Regional Science Annual Conference*: Jyväskylä.

Huber J. and Zwerina K. (1996). The importance of utility balance in efficient choice designs. *Journal of Marketing Research* **33**(3): 307-317.

Kanninen B.J. (2002). Optimal design for multinomial choice experiments. *Journal of Marketing Research* **39**(2): 214-227.

Kontoleon A. and Yabe M. (2003). Assessing the impacts of alternative 'opt-out' formats in choice experiment studies: consumer preferences for genetically modified content and production information in food. *Journal of Agricultural Policy and Resources* **5**: 1-43.

Lancaster K.J. (1966). A new approach to consumer theory. *The Journal of Political Economy* **74**(2): 132-157.

Layton D.F. and Brown G. (2000). Hetergeneous preferences regarding global climate change. *The review of economics and statistics* **82**(4): 616-624.

Lehtonen E., Kuuluvainen J., Pouta E., Rekola M. and Li CZ. (2003). Non-market benefits of forest conservation in sourthern Finland. *Environmental Science & Policy* **6**: 195-204.

Lockwood M. (1996). Non-compensatory preference structures in non-market valuation of natural area policy. *Australian Journal of Agricultural Economics* **40**(2): 73-87.

Louviere J.J. (2001). Choice experiments: an overview of concepts and issues. In J.W. Bennett and R. Blamey (Eds.), *The choice modelling approach to environmental valuation*. Edward Elgar: Cheltenham.

Louviere J.J. and Hensher D.A. (1982). Design and analysis of simulated choice or allocation experiments in travel choice modeling. *Transportation Research Record* **890**: 11-17.

Louviere J.J. and Woodworth G. (1983). Design and analysis of simulated consumer choice or allocation experiments: an approach based on aggregate data. *Journal of Marketing Research* **20**: 350-357.

Luce M.F., Payne J.W. and Bettman J.R. (2000). Coping with unfavorable attribute values in choice. *Organizational Behavior and Human Decision Processes* **81**(2): 274-299.

Lusk, J.L. and Norwood F.B. (2005). Effect of experimental design on choice-based conjoint valuation estimates. *American Journal Of Agricultural Economics* **87**(3): 771-785.

McFadden D.L. and Train K.E. (2000). Mixed MNL models for discrete response. *Journal of Applied Econometrics* **15**: 447-470.

McIntosh E and Ryan M. (2002). Using discrete choice experiments to derive welfare estimates for the provision of elective surgery: impliactions of discontinuous preferences. *Journal of Economic Psychology* **23**: 367-382.

Rekola M. (2003). Lexicographic preferences in contingent valuation: a theoretical framework with illustrations. *Land Economics* **79**(2): 277-291.

Revelt D. and Train K.E. (1998). Mixed logit with repeated choices: households' choices of appliance efficiency level. *The review of economics and statistics* **80**(4): 647-657.

Rizzi L.I. and Ortúzar J.D. (2003). Stated preference in the valuation of interurban road safety. *Accident Analysis & Prevention* **35**: 9-22.

Rosenberger R.S., Peterson G.L., Clarke A. and Brown T.C. (2003). Measuring dispositions for lexicographic preferences of environmental goods: integrating economics, psychology and ethics. *Ecological Economics* **44**: 63-76.

Ryan M. and Bate A. (2001). Testing the assumptions of rationality, continuity and symmetry when applying discrete choice experiments in health care. *Applied Economic Letters* **8**: 59-63.

Sælensminde K. (2001). Inconsistent choices in stated choice data: use of the logit scaling approach to handle resulting variance increases. *Transportation* **28**: 269-296.

Sælensminde K. (2002). The impact of choice inconsistencies in stated choice studies. *Environmental and Resource Economics* **23**: 403-420.

Samuelson W. and Zeckhauser R. (1988). Status-quo bias in decision-making. *Journal of Risk and Uncertainty* **24**(1): 7-59.

Sánder Z. and Webel M. (2001). Designing conjoint choice experiments using managers' prior beliefs. *Journal of Marketing Research* **38**: 430-444.

Scarpa R., Campbell D. and Hutchinson W.G. (2005). Individual benefit estimates for rural landscape improvements: the role of sequential Bayesian design and response rationality in a choice experiment study, *European Association of Environmental and Resource Economists Annual Conference*: Bremen.

Sillano M. and Ortúzar J.D. (2005). Willingness-to-pay estimation with mixed logit models: some new evidence. *Environment and Planning A* **37**: 525-550.

Spash C.L. (2000). Ecosystems, contingent valuation and ethics: the case of wetland re-creation. *Ecological Economics* **34**: 195-215.

Spash C.L. and Hanley N. (1995). Preferences, information and biodiversity preservation. *Ecological Economics* **12**: 191-208.

Swait J. and Adamowicz W. (2001). Choice environment, market complexity, and consumer behavior: a theoretical and empirical approach for incorporating decision complexity into models of consumer choice. *Organizational Behavior and Human Decision Processes* **86**(2): 141-167.

Train K.E. (1998). Recreation demand models with taste differences over people. *Land Economics* **74**(2): 230-239.

Train K.E. (1999). *Halton sequences for mixed logit*. University of California: Berkley.

Train K.E. (2003). *Discrete choice methods with simulation*. Cambridge University Press: Cambridge.

Train K.E and Sonnier G. (2005). Mixed logit with bounded distributions of correlated partworths. In R. Scarpa and A. Alberini (Eds.), *Applications of simulation methods in environmental and resource economics*. Springer: Dordrecht.

Train K.E. and Weeks M. (2005). Discrete choice models in preference space and willing-to-pay space. In R. Scarpa and A. Alberini (Eds.), *Applications of simulation methods in environmental and resource economics*. Springer: Dordrecht.

NOTE DI LAVORO DELLA FONDAZIONE ENI ENRICO MATTEI

Fondazione Eni Enrico Mattei Working Paper Series

Our Note di Lavoro are available on the Internet at the following addresses:

http://www.feem.it/Feem/Pub/Publications/WPapers/default.html
http://www.ssrn.com/link/feem.html
http://www.repec.org
http://agecon.lib.umn.edu

NOTE DI LAVORO PUBLISHED IN 2006

SIEV	1.2006	*Anna ALBERINI*: Determinants and Effects on Property Values of Participation in Voluntary Cleanup Programs: The Case of Colorado
CCMP	2.2006	*Valentina BOSETTI, Carlo CARRARO and Marzio GALEOTTI*: Stabilisation Targets, Technical Change and the Macroeconomic Costs of Climate Change Control
CCMP	3.2006	*Roberto ROSON*: Introducing Imperfect Competition in CGE Models: Technical Aspects and Implications
KTHC	4.2006	*Sergio VERGALLI*: The Role of Community in Migration Dynamics
SIEV	5.2006	*Fabio GRAZI, Jeroen C.J.M. van den BERGH and Piet RIETVELD*: Modeling Spatial Sustainability: Spatial Welfare Economics versus Ecological Footprint
CCMP	6.2006	*Olivier DESCHENES and Michael GREENSTONE*: The Economic Impacts of Climate Change: Evidence from Agricultural Profits and Random Fluctuations in Weather
PRCG	7.2006	*Michele MORETTO and Paola VALBONESE*: Firm Regulation and Profit-Sharing: A Real Option Approach
SIEV	8.2006	*Anna ALBERINI and Aline CHIABAI*: Discount Rates in Risk v. Money and Money v. Money Tradeoffs
CTN	9.2006	*Jon X. EGUIA*: United We Vote
CTN	10.2006	*Shao CHIN SUNG and Dinko DIMITRO*: A Taxonomy of Myopic Stability Concepts for Hedonic Games
NRM	11.2006	*Fabio CERINA* (lxxviii): Tourism Specialization and Sustainability: A Long-Run Policy Analysis
NRM	12.2006	*Valentina BOSETTI, Mariaester CASSINELLI and Alessandro LANZA* (lxxviii): Benchmarking in Tourism Destination, Keeping in Mind the Sustainable Paradigm
CCMP	13.2006	*Jens HORBACH*: Determinants of Environmental Innovation – New Evidence from German Panel Data Sources
KTHC	14.2006	*Fabio SABATINI*: Social Capital, Public Spending and the Quality of Economic Development: The Case of Italy
KTHC	15.2006	*Fabio SABATINI*: The Empirics of Social Capital and Economic Development: A Critical Perspective
CSRM	16.2006	*Giuseppe DI VITA*: Corruption, Exogenous Changes in Incentives and Deterrence
CCMP	17.2006	*Rob B. DELLINK and Marjan W. HOFKES*: The Timing of National Greenhouse Gas Emission Reductions in the Presence of Other Environmental Policies
IEM	18.2006	*Philippe QUIRION*: Distributional Impacts of Energy-Efficiency Certificates Vs. Taxes and Standards
CTN	19.2006	*Somdeb LAHIRI*: A Weak Bargaining Set for Contract Choice Problems
CCMP	20.2006	*Massimiliano MAZZANTI and Roberto ZOBOLI*: Examining the Factors Influencing Environmental Innovations
SIEV	21.2006	*Y. Hossein FARZIN and Ken-ICHI AKAO*: Non-pecuniary Work Incentive and Labor Supply
CCMP	22.2006	*Marzio GALEOTTI, Matteo MANERA and Alessandro LANZA*: On the Robustness of Robustness Checks of the Environmental Kuznets Curve
NRM	23.2006	*Y. Hossein FARZIN and Ken-ICHI AKAO*: When is it Optimal to Exhaust a Resource in a Finite Time?
NRM	24.2006	*Y. Hossein FARZIN and Ken-ICHI AKAO*: Non-pecuniary Value of Employment and Natural Resource Extinction
SIEV	25.2006	*Lucia VERGANO and Paulo A.L.D. NUNES:* Analysis and Evaluation of Ecosystem Resilience: An Economic Perspective
SIEV	26.2006	*Danny CAMPBELL, W. George HUTCHINSON and Riccardo SCARPA*: Using Discrete Choice Experiments to Derive Individual-Specific WTP Estimates for Landscape Improvements under Agri-Environmental Schemes Evidence from the Rural Environment Protection Scheme in Ireland
KTHC	27.2006	*Vincent M. OTTO, Timo KUOSMANEN and Ekko C. van IERLAND*: Estimating Feedback Effect in Technical Change: A Frontier Approach
CCMP	28.2006	*Giovanni BELLA*: Uniqueness and Indeterminacy of Equilibria in a Model with Polluting Emissions
IEM	29.2006	*Alessandro COLOGNI and Matteo MANERA*: The Asymmetric Effects of Oil Shocks on Output Growth: A Markov-Switching Analysis for the G-7 Countries
KTHC	30.2006	*Fabio SABATINI*: Social Capital and Labour Productivity in Italy
ETA	31.2006	*Andrea GALLICE* (lxxix): Predicting one Shot Play in 2x2 Games Using Beliefs Based on Minimax Regret
IEM	32.2006	*Andrea BIGANO and Paul SHEEHAN*: Assessing the Risk of Oil Spills in the Mediterranean: the Case of the Route from the Black Sea to Italy
NRM	33.2006	*Rinaldo BRAU and Davide CAO* (lxxviii): Uncovering the Macrostructure of Tourists' Preferences. A Choice Experiment Analysis of Tourism Demand to Sardinia
CTN	34.2006	*Parkash CHANDER and Henry TULKENS*: Cooperation, Stability and Self-Enforcement in International Environmental Agreements: A Conceptual Discussion
IEM	35.2006	*Valeria COSTANTINI and Salvatore MONNI*: Environment, Human Development and Economic Growth
ETA	36.2006	*Ariel RUBINSTEIN* (lxxix): Instinctive and Cognitive Reasoning: A Study of Response Times

ETA	37.2006	*Maria SALGADO* (lxxix): Choosing to Have Less Choice
ETA	38.2006	*Justina A.V. FISCHER and Benno TORGLER*: Does Envy Destroy Social Fundamentals? The Impact of Relative Income Position on Social Capital
ETA	39.2006	*Benno TORGLER, Sascha L. SCHMIDT and Bruno S. FREY*: Relative Income Position and Performance: An Empirical Panel Analysis
CCMP	40.2006	*Alberto GAGO, Xavier LABANDEIRA, Fidel PICOS And Miguel RODRÍGUEZ*: Taxing Tourism In Spain: Results and Recommendations
IEM	41.2006	*Karl van BIERVLIET, Dirk Le ROY and Paulo A.L.D. NUNES*: An Accidental Oil Spill Along the Belgian Coast: Results from a CV Study
CCMP	42.2006	*Rolf GOLOMBEK and Michael HOEL*: Endogenous Technology and Tradable Emission Quotas
KTHC	43.2006	*Giulio CAINELLI and Donato IACOBUCCI*: The Role of Agglomeration and Technology in Shaping Firm Strategy and Organization
CCMP	44.2006	*Alvaro CALZADILLA, Francesco PAULI and Roberto ROSON*: Climate Change and Extreme Events: An Assessment of Economic Implications
SIEV	45.2006	*M.E. KRAGT, P.C. ROEBELING and A. RUIJS*: Effects of Great Barrier Reef Degradation on Recreational Demand: A Contingent Behaviour Approach
NRM	46.2006	*C. GIUPPONI, R. CAMERA, A. FASSIO, A. LASUT, J. MYSIAK and A. SGOBBI*: Network Analysis, Creative System Modelling and DecisionSupport: *The NetSyMoD Approach*
KTHC	47.2006	*Walter F. LALICH* (lxxx): Measurement and Spatial Effects of the Immigrant Created Cultural Diversity in Sydney
KTHC	48.2006	*Elena PASPALANOVA* (lxxx): Cultural Diversity Determining the Memory of a Controversial Social Event
KTHC	49.2006	*Ugo GASPARINO, Barbara DEL CORPO and Dino PINELLI* (lxxx): Perceived Diversity of Complex Environmental Systems: Multidimensional Measurement and Synthetic Indicators
KTHC	50.2006	*Aleksandra HAUKE* (lxxx): Impact of Cultural Differences on Knowledge Transfer in British, Hungarian and Polish Enterprises
KTHC	51.2006	*Katherine MARQUAND FORSYTH and Vanja M. K. STENIUS* (lxxx): The Challenges of Data Comparison and Varied European Concepts of Diversity
KTHC	52.2006	*Gianmarco I.P. OTTAVIANO and Giovanni PERI* (lxxx): Rethinking the Gains from Immigration: Theory and Evidence from the U.S.
KTHC	53.2006	*Monica BARNI* (lxxx): From Statistical to Geolinguistic Data: Mapping and Measuring Linguistic Diversity
KTHC	54.2006	*Lucia TAJOLI and Lucia DE BENEDICTIS* (lxxx): Economic Integration and Similarity in Trade Structures
KTHC	55.2006	*Suzanna CHAN* (lxxx): "God's Little Acre" and "Belfast Chinatown": Diversity and Ethnic Place Identity in Belfast
KTHC	56.2006	*Diana PETKOVA* (lxxx): Cultural Diversity in People's Attitudes and Perceptions
KTHC	57.2006	John J. *BETANCUR* (lxxx): From Outsiders to On-Paper Equals to Cultural Curiosities? The Trajectory of Diversity in the USA
KTHC	58.2006	*Kiflemariam HAMDE* (lxxx): Cultural Diversity A Glimpse Over the Current Debate in Sweden
KTHC	59.2006	*Emilio GREGORI* (lxxx): Indicators of Migrants' Socio-Professional Integration
KTHC	60.2006	*Christa-Maria LERM HAYES* (lxxx): Unity in Diversity Through Art? Joseph Beuys' Models of Cultural Dialogue
KTHC	61.2006	*Sara VERTOMMEN and Albert MARTENS* (lxxx): Ethnic Minorities Rewarded: Ethnostratification on the Wage Market in Belgium
KTHC	62.2006	*Nicola GENOVESE and Maria Grazia LA SPADA* (lxxx): Diversity and Pluralism: An Economist's View
KTHC	63.2006	*Carla BAGNA* (lxxx): Italian Schools and New Linguistic Minorities: Nationality Vs. Plurilingualism. Which Ways and Methodologies for Mapping these Contexts?
KTHC	64.2006	*Vedran OMANOVIĆ* (lxxx): Understanding "Diversity in Organizations" Paradigmatically and Methodologically
KTHC	65.2006	*Mila PASPALANOVA* (lxxx): Identifying and Assessing the Development of Populations of Undocumented Migrants: The Case of Undocumented Poles and Bulgarians in Brussels
KTHC	66.2006	*Roberto ALZETTA* (lxxx): Diversities in Diversity: Exploring Moroccan Migrants' Livelihood in Genoa
KTHC	67.2006	*Monika SEDENKOVA and Jiri HORAK* (lxxx): Multivariate and Multicriteria Evaluation of Labour Market Situation
KTHC	68.2006	*Dirk JACOBS and Andrea REA* (lxxx): Construction and Import of Ethnic Categorisations: "Allochthones" in The Netherlands and Belgium
KTHC	69.2006	*Eric M. USLANER* (lxxx): Does Diversity Drive Down Trust?
KTHC	70.2006	*Paula MOTA SANTOS and João BORGES DE SOUSA* (lxxx): Visibility & Invisibility of Communities in Urban Systems
ETA	71.2006	*Rinaldo BRAU and Matteo LIPPI BRUNI*: Eliciting the Demand for Long Term Care Coverage: A Discrete Choice Modelling Analysis
CTN	72.2006	*Dinko DIMITROV and Claus-JOCHEN HAAKE*: Coalition Formation in Simple Games: The Semistrict Core
CTN	73.2006	*Ottorino CHILLEM, Benedetto GUI and Lorenzo ROCCO*: On The Economic Value of Repeated Interactions Under Adverse Selection
CTN	74.2006	*Sylvain BEAL and Nicolas QUÉROU*: Bounded Rationality and Repeated Network Formation
CTN	75.2006	*Sophie BADE, Guillaume HAERINGER and Ludovic RENOU*: Bilateral Commitment
CTN	76.2006	*Andranik TANGIAN*: Evaluation of Parties and Coalitions After Parliamentary Elections
CTN	77.2006	*Rudolf BERGHAMMER, Agnieszka RUSINOWSKA and Harrie de SWART*: Applications of Relations and Graphs to Coalition Formation
CTN	78.2006	*Paolo PIN*: Eight Degrees of Separation
CTN	79.2006	*Roland AMANN and Thomas GALL*: How (not) to Choose Peers in Studying Groups

CTN	80.2006	*Maria MONTERO*: Inequity Aversion May Increase Inequity
CCMP	81.2006	*Vincent M. OTTO, Andreas LÖSCHEL and John REILLY*: Directed Technical Change and Climate Policy
CSRM	82.2006	*Nicoletta FERRO*: Riding the Waves of Reforms in Corporate Law, an Overview of Recent Improvements in Italian Corporate Codes of Conduct
CTN	83.2006	*Siddhartha BANDYOPADHYAY and Mandar OAK*: Coalition Governments in a Model of Parliamentary Democracy
PRCG	84.2006	*Raphaël SOUBEYRAN*: Valence Advantages and Public Goods Consumption: Does a Disadvantaged Candidate Choose an Extremist Position?
CCMP	85.2006	*Eduardo L. GIMÉNEZ and Miguel RODRÍGUEZ*: Pigou's Dividend versus Ramsey's Dividend in the Double Dividend Literature
CCMP	86.2006	*Andrea BIGANO, Jacqueline M. HAMILTON and Richard S.J. TOL*: The Impact of Climate Change on Domestic and International Tourism: A Simulation Study
KTHC	87.2006	*Fabio SABATINI*: Educational Qualification, Work Status and Entrepreneurship in Italy an Exploratory Analysis
CCMP	88.2006	*Richard S.J. TOL*: The Polluter Pays Principle and Cost-Benefit Analysis of Climate Change: An Application of *Fund*
CCMP	89.2006	*Philippe TULKENS and Henry TULKENS*: The White House and The Kyoto Protocol: Double Standards on Uncertainties and Their Consequences
SIEV	90.2006	*Andrea M. LEITER and Gerald J. PRUCKNER*: Proportionality of Willingness to Pay to Small Risk Changes – The Impact of Attitudinal Factors in Scope Tests
PRCG	91.2006	*Raphäel SOUBEYRAN*: When Inertia Generates Political Cycles
CCMP	92.2006	*Alireza NAGHAVI*: Can R&D-Inducing Green Tariffs Replace International Environmental Regulations?
CCMP	93.2006	*Xavier PAUTREL*: Reconsidering The Impact of Environment on Long-Run Growth When Pollution Influences Health and Agents Have Finite-Lifetime
CCMP	94.2006	*Corrado Di MARIA and Edwin van der WERF*: Carbon Leakage Revisited: Unilateral Climate Policy with Directed Technical Change
CCMP	95.2006	*Paulo A.L.D. NUNES and Chiara M. TRAVISI*: Comparing Tax and Tax Reallocations Payments in Financing Rail Noise Abatement Programs: Results from a CE valuation study in Italy
CCMP	96.2006	*Timo KUOSMANEN and Mika KORTELAINEN*: Valuing Environmental Factors in Cost-Benefit Analysis Using Data Envelopment Analysis
KTHC	97.2006	*Dermot LEAHY and Alireza NAGHAVI*: Intellectual Property Rights and Entry into a Foreign Market: FDI vs. Joint Ventures
CCMP	98.2006	*Inmaculada MARTÍNEZ-ZARZOSO, Aurelia BENGOCHEA-MORANCHO and Rafael MORALES LAGE:* The Impact of Population on CO2 Emissions: Evidence from European Countries
PRCG	99.2006	*Alberto CAVALIERE and Simona SCABROSETTI*: Privatization and Efficiency: From Principals and Agents to Political Economy
NRM	100.2006	*Khaled ABU-ZEID and Sameh AFIFI*: Multi-Sectoral Uses of Water & Approaches to DSS in Water Management in the NOSTRUM Partner Countries of the Mediterranean
NRM	101.2006	*Carlo GIUPPONI, Jaroslav MYSIAK and Jacopo CRIMI*: Participatory Approach in Decision Making Processes for Water Resources Management in the Mediterranean Basin
CCMP	102.2006	*Kerstin RONNEBERGER, Maria BERRITTELLA, Francesco BOSELLO and Richard S.J. TOL*: Klum@Gtap: Introducing Biophysical Aspects of Land-Use Decisions Into a General Equilibrium Model A Coupling Experiment
KTHC	103.2006	*Avner BEN-NER, Brian P. McCALL, Massoud STEPHANE, and Hua WANG*: Identity and Self-Other Differentiation in Work and Giving Behaviors: Experimental Evidence
SIEV	104.2006	*Aline CHIABAI and Paulo A.L.D. NUNES*: Economic Valuation of Oceanographic Forecasting Services: A Cost-Benefit Exercise
NRM	105.2006	*Paola MINOIA and Anna BRUSAROSCO*: Water Infrastructures Facing Sustainable Development Challenges: Integrated Evaluation of Impacts of Dams on Regional Development in Morocco
PRCG	106.2006	*Carmine GUERRIERO*: Endogenous Price Mechanisms, Capture and Accountability Rules: Theory and Evidence
CCMP	107.2006	*Richard S.J. TOL, Stephen W. PACALA and Robert SOCOLOW*: Understanding Long-Term Energy Use and Carbon Dioxide Emissions in the Usa
NRM	108.2006	*Carles MANERA and Jaume GARAU TABERNER*: The Recent Evolution and Impact of Tourism in the Mediterranean: The Case of Island Regions, 1990-2002
PRCG	109.2006	*Carmine GUERRIERO*: Dependent Controllers and Regulation Policies: Theory and Evidence
KTHC	110.2006	*John FOOT* (lxxx): Mapping Diversity in Milan. Historical Approaches to Urban Immigration
KTHC	111.2006	*Donatella CALABI*: Foreigners and the City: An Historiographical Exploration for the Early Modern Period
IEM	112.2006	*Andrea BIGANO, Francesco BOSELLO and Giuseppe MARANO*: Energy Demand and Temperature: A Dynamic Panel Analysis
SIEV	113.2006	*Anna ALBERINI, Stefania TONIN, Margherita TURVANI and Aline CHIABAI*: Paying for Permanence: Public Preferences for Contaminated Site Cleanup
CCMP	114.2006	*Vivekananda MUKHERJEE and Dirk T.G. RÜBBELKE*: Global Climate Change, Technology Transfer and Trade with Complete Specialization
NRM	115.2006	*Clive LIPCHIN*: A Future for the Dead Sea Basin: Water Culture among Israelis, Palestinians and Jordanians
CCMP	116.2006	*Barbara BUCHNER, Carlo CARRARO and A. Denny ELLERMAN*: The Allocation of European Union Allowances: Lessons, Unifying Themes and General Principles
CCMP	117.2006	*Richard S.J. TOL*: Carbon Dioxide Emission Scenarios for the Usa

NRM	118.2006	*Isabel CORTÉS-JIMÉNEZ and Manuela PULINA*: A further step into the ELGH and TLGH for Spain and Italy
SIEV	119.2006	*Beat HINTERMANN, Anna ALBERINI and Anil MARKANDYA*: Estimating the Value of Safety with Labor Market Data: Are the Results Trustworthy?
SIEV	120.2006	*Elena STRUKOVA, Alexander GOLUB and Anil MARKANDYA*: Air Pollution Costs in Ukraine
CCMP	121.2006	*Massimiliano MAZZANTI, Antonio MUSOLESI and Roberto ZOBOLI*: A Bayesian Approach to the Estimation of Environmental Kuznets Curves for CO_2 Emissions
ETA	122.2006	*Jean-Marie GRETHER, Nicole A. MATHYS, and Jaime DE MELO*: Unraveling the World-Wide Pollution Haven Effect
KTHC	123.2006	*Sergio VERGALLI*: Entry and Exit Strategies in Migration Dynamics
PRIV	124.2006	*Bernardo BORTOLOTTI and Valentina MILELLA*: Privatization in Western Europe Stylized Facts, Outcomes and Open Issues
SIEV	125.2006	*Pietro CARATTI, Ludovico FERRAGUTO and Chiara RIBOLDI*: Sustainable Development Data Availability on the Internet
SIEV	126.2006	*S. SILVESTRI, M PELLIZZATO and V. BOATTO*: Fishing Across the Centuries: What Prospects for the Venice Lagoon?
CTN	127.2006	*Alison WATTS*: Formation of Segregated and Integrated Groups
SIEV	128.2006	*Danny CAMPBELL, W. George HUTCHINSON and Riccardo SCARPA*: Lexicographic Preferences in Discrete Choice Experiments: Consequences on Individual-Specific Willingness to Pay Estimates

(lxxviii) This paper was presented at the Second International Conference on "Tourism and Sustainable Economic Development - Macro and Micro Economic Issues" jointly organised by CRENoS (Università di Cagliari and Sassari, Italy) and Fondazione Eni Enrico Mattei, Italy, and supported by the World Bank, Chia, Italy, 16-17 September 2005.
(lxxix) This paper was presented at the International Workshop on "Economic Theory and Experimental Economics" jointly organised by SET (Center for advanced Studies in Economic Theory, University of Milano-Bicocca) and Fondazione Eni Enrico Mattei, Italy, Milan, 20-23 November 2005. The Workshop was co-sponsored by CISEPS (Center for Interdisciplinary Studies in Economics and Social Sciences, University of Milan-Bicocca).
(lxxx) This paper was presented at the First EURODIV Conference "Understanding diversity: Mapping and measuring", held in Milan on 26-27 January 2006 and supported by the Marie Curie Series of Conferences "Cultural Diversity in Europe: a Series of Conferences.

2006 SERIES

CCMP	*Climate Change Modelling and Policy* (Editor: Marzio Galeotti)
SIEV	*Sustainability Indicators and Environmental Valuation* (Editor: Anna Alberini)
NRM	*Natural Resources Management* (Editor: Carlo Giupponi)
KTHC	*Knowledge, Technology, Human Capital* (Editor: Gianmarco Ottaviano)
IEM	*International Energy Markets* (Editor: Matteo Manera)
CSRM	*Corporate Social Responsibility and Sustainable Management* (Editor: Giulio Sapelli)
PRCG	*Privatisation Regulation Corporate Governance* (Editor: Bernardo Bortolotti)
ETA	*Economic Theory and Applications* (Editor: Carlo Carraro)
CTN	*Coalition Theory Network*